

COURSE INFORMATION

ALTERNATIVE ENERGIES

Code number: 60810228

Degree in Mine exploitation engineering and energetic resources

Department of Mining, Mechanical, Energy and Construction Engineering

ACADEMIC YEAR: 2017-2018

Course type: Compulsory. 3rd year

Second semester: 3 hours a week

6 ECTS

Link to Spanish counterpart: <http://www.uhu.es/etsi/guia-de-asignatura/?codigo=606810228>

TEACHING STAFF

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Office hours:

First Semestre: Wednesday (10,00-11,30 h) and Friday (13,00-14,30 h)

Second Semestre: Tuesday (11,30-13,00 h) and Thursday (8,30-11,30 and 13,00-14,30 h)

PROGRAMME

1. DESCRIPTION

Green power describes the production of electricity from renewable sources which are less harmful to the environment than fossil fuels. Renewable energy is an unending source of energy which replenish itself quickly in a natural process. The various types of renewable energies are: **wind, solar, geothermal, biofuels, hydraulic, oceanic, hydrogen, nuclear fusion.**

Cogeneration, otherwise known as combined heat and power (CHP), is the simultaneous production of electricity and heat from a single fuel source, commonly natural gas. Trigeneration, is an extension of cogeneration which involves the simultaneous production of electricity, heating and cooling.

Climate change and fossil fuel. In this context of energy consumption and the awareness the climate changes we have to look at the renewable energies as a possible solution for climate problems. Sustainable development means that society meets its present needs while preserving the ability of future generations to meet their own needs. The goals are economic prosperity, social equity and environmental protection.

Energy storage; since the discovery of electricity, we have sought effective methods to store that energy for use on demand. Over the last century, the energy storage industry has continued to evolve and adapt to changing energy requirements and advances in technology

The last topic is about **energy, economics and environment.** It is another view on the topic of renewable energy as it does not consider the technical terms of renewable energy but the economic ones.

In conclusion it is obvious that the countries currently are highly dependent on fossil fuel. The use of renewable energy would lower production costs. Moreover, renewables and alternative energies are a possibility to supply the individual household and could end the state of energy supply as a political issue.

2. PREREQUISITES

It is advisable to have passed the subjects of 1st and 2nd courses.

3. LEARNING OUTCOMES

The aim of this module is to provide the student with a critical understanding of the theoretical, conceptual and methodological options available for Renewable Energies.

Skills: to design, analyze, carry out, and produce a report for a research project in any of the topics of the subject. An advanced level of knowledge of Renewable Energies.

By the end of the module students should be able to:

Appreciate quality of life versus Energy Demand. Analyze, calculate and evaluate what Renewable Energies provide for the transition from an energy portfolio dominated by fossil fuels to an energy portfolio that includes a range of fuel types. Articulate a knowledge of solar, wind, biomass and synfuels, geothermal, hydraulic, oceanic and nuclear fusion power plants. Use, conduct and develop skills in the oral exhibition of power point presentations related with the topics of R.E. Critically engage with diverse opinions about the climate change, energy store and energy, economics and environment.

4. COMPETENCES

CB1
CB2
CB3
CB4
CG07
CG16
CG17
T01
T02

5. TEACHING METHODOLOGY

Course work and Assignments:

Weekly delivery of an abstract (report) of the lesson with the topics of the program in 10 pages. Send it by email (in the subject of the e-mail: name, topic and subject).

Every student will have to expose between 3 and 5 lessons of the program that will have been prepared before. The rest will prepare two questions on the topic and a question-and-answer session will be opened. The moderator will be the student who exposes the topic of the day. The exhibitions (Power Point presentations or similar) will be 30 minutes long (each student) and will be valued the assimilation of the basic concepts of every topic and the oral and visual presentation of the slides. This means that the pupil has to be present in class regularly and has to show a participative

attitude in class. In addition, the teacher will be able to request the pupils the preparation of some articles of interest that will be debated in class.

Participation: Assistance (maximum 2 absences to class without justification).

Exam (100%) For those who are not present at class or who do not overcome the continuous assessment there is an examination of the total content of the program.

Extended essay: A bibliographical and individual Memory during the semester related to any of the topics of the program (optional)

6. CONTENTS

LESSON 1. GENERALITIES.

- 1.1. Energy: definition, classification, units of measure and sources. Conversion between energy forms.
- 1.2. Generalities.
- 1.3. Gas emission.
- 1.4. Energy consumption.
- 1.5. Non-renewable energies.
- 1.6. Renewable energies.
- 1.7. Diverse opinions about the climate change.

LESSON 2. SOLAR ENERGY.

- 2.1 The Sun like source of energy.
- 2.2 Solar power plants: thermal, thermoelectric and photovoltaic.
- 2.3 Solar Thermal power generation.
- 2.4 Solar Photovoltaic or solar cells.
- 2.5 Perspective of the market of the solar power in Spain.

LESSON 3. WIND ENERGY.

- 3.1. The origin of the wind and wind power.
- 3.2. Brief history of the wind utilization.
- 3.3. Wind turbines.
- 3.4. Wind farms.
- 3.5. Environmental impact.
- 3.6. Possibilities for the applications of the wind power in Spain.

LESSON 4. BIOENERGY AND BIOFUELS.

- 4.1. Origins and classification of the biomass.
- 4.2. Transformation of the biomass in energy. Biological conversion and thermal processes.
- 4.3. Types and applications of the biomass (methane, Biodiesel and Bioethanol).
- 4.4. Recent developments to increase the performance of the biomasses.
- 4.5. Plants and transgenic trees for the production of biomass.
- 4.6. Biogas and cogeneration power plants.
- 4.7. Synfuels in commercial aviation.

LESSON 5. HYDROGENE.

- 5.1 Hydrogen in the earth and in the universe.
- 5.2 The energetic point of view of the hydrogen.
- 5.3 Fuel Cells. Production and storage of Hydrogen.
- 5.4 Types of Fuel Cells.
- 5.5. Hybrid vehicles.
- 5.6. Electric car and other ecological vehicles.
- 5.7 Fuel Cells for aviation.
- 5.8 Hydrogen production from the water.
- 5.9 What does the future hold?

LESSON 6. GEOTHERMAL ENERGY.

- 6.1 The geothermal phenomenon.
- 6.2 Geothermal heat pumps.
- 6.3 Direct use and applications.
- 6.4 Geothermal heating systems.
- 6.5 Geothermal power plants
- 6.6 Managing geothermal reservoirs
- 6.7 Hot, Dry Rock

LESSON 7. THE HYDRAULIC ENERGY.

- 7.1. The power of water.
- 7.2. Historical evolution of the hydraulic utilization.
- 7.3. Hydraulic power and hydroelectric power plants.
- 7.4. Types of hydroelectric power plants
- 7.5 Hydroelectric power plants in Spain and over the world.
- 7.6 Advantages and disadvantages of Hydroelectric power plants.

LESSON 8. OCEANIC ENERGY.

- 8.1. Generalities
- 8.2. Tidal power (Maremotriz).
- 8.3 Tidal power plants.
- 8.4. The project of Kislava's Bay.
- 8.5. Waves power.
- 8.6. Extraction of wave power.
- 8.7. Thermal ocean power.

LESSON 9. COGENERATION.

- 9.1. Cogeneration. Trigeneration. Energy efficiency. Cogeneration technologies
- 9.2. Benefits of cogeneration.
- 9.3. How does cogeneration improve fuel efficiency?
- 9.4. Components of a cogeneration system
- 9.5 Off-site or district systems.
- 9.6 Business case considerations.

LESSON 10. NUCLEAR FUSION.

- 10.1. The power of a star.
- 10.2. Solar fusion.
- 10.3. Hydrogen in nuclear fusion
- 10.4. Power liberation in the nuclear fusion
- 10.5. ITER experimental reactor

LESSON 11. CLIMATE CHANGE AND FOSSIL FUELS

- 11.1. Problems created by fossil fuels
- 11.2. Acid rain.
- 11.3. The greenhouse effect.
- 11.4. The ozone layer.
- 11.5. Climate change.
- 11.5. Kyoto protocol.

LESSON 12. STORAGE TECHNOLOGIES.

- 12.1. Types of energy storage.
- 12.2. Pumped storage hydropower.
- 12.3. Compressed air energy storage.
- 12.4. Large-scale batteries.
- 12.5. Superconducting magnetic storage.
- 12.6. Flywheels.
- 12.7. Capacitors. Hydrogen. Environmental considerations.
- 12.8. Costs.

LESSON 13. ENERGY, ECONOMICS AND ENVIROMENT.

- 13.1. Energy conservation and cogeneration.
- 13.2. Energy and the environment
- 13.3. Economics.
- 13.4. Life cycle analysis.
- 13.5. Sustainable development: A compelling scenario.
- 13.6. Energy and ethics.
- 13.7. Energy and geopolitics.

7. BIBLIOGRAPHY

BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier

FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K.

SABONNADIÈRE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd & Wiley & Sons

VIERIRA DA ROSA, A; (2009). "Fundamentals of Renewable Energy processes". 2nd Ed. Elsevier.

ZILBERMAN, D. et al. (2010) "Handbook of Bioenergy Economics and Policy". Springer

<https://www.dropbox.com/home/Renewable%20Energies>

CREUS SOLÉ, A. (2008); "Aerogeneradores"; Editorial técnica

CREUS SOLÉ, A. (2009); "Energías Renovables" 2ª Ed. Editorial técnica.

ESCUADERO LÓPEZ, J. M. (2008) "Manual de energía eólica". " 2ª Ed. Ediciones mundi-Prensa

FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K.

FERNÁNDEZ SALGADO, J. M. (2009); "Compendio de energía solar: Fotovoltaica, Térmica y Termoeléctrica"; AMV EDICIONES

FERNÁNDEZ SALGADO, J. M. (2009); "Tecnología de las Energías Renovables"; AMV EDICIONES

JARABO, F. y ELORTEGUI, N.; Energías renovables. SAPT Publicaciones Técnicas, S.L. Madrid (2000). Capítulo 8.

8. ASSESSMENT

Continuous assessment for course based in:

1. **The exhibitions** (Power Point presentations or other) will be 30 minutes long and will be valued the assimilation of the basic concepts of every topic and the oral and visual presentation of the slides. (60%).
2. **Weekly delivery of an abstract (report)** of the lesson with the topics of the program in 8 pages. Send it by email. (40%).
3. **Assistance** (maximum 2 absences to class without justification).
4. **Participative and respectful attitude** in class

For those who are not present at class or who do not overcome the continuous assessment there is an examination of the total content of the program:

- a) Examination with five short questions (1 point each one) and a development question choosing between two proposed topics (5 points).

In addition, students interested in raising the evaluation mark, will be able to realize a bibliographical and individual Memory during the semester related to any of the topics of the program. This Memory has to be delivered before the date of the examination.